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## ABSTRACT

This presentation explores a theoretical framework and a practical procedure for assessing an urban school physical environment to identify its perceived impacts on the educational process, and reviews and critiques assessment models identified in the literature for assessing the quality of the physical environment. The Baltimore City Public Schools Environment Quality Assessment Project, which included five post-occupancy evaluations, is used to illustrate the potential use of the assessment procedure in practice. Project outcomes highlighted include student academic performance, student social development, and teacher instructional performance. Concluding comments emphasize the value of institutionalizing an on-going process of environmental quality assessment that has implications for integrating facilities management and educational decisions for the benefit of the educational process. The Powerpoint presentation is included. (GR)

J. Lackney

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# Assessing School Facilities for Learning/Assessing the Impact of the Physical Environment on the Educational Process: Integrating Theoretical Issues with Practical Concerns

Jeffery A. Lackney, R.A., Ph.D.

UEF21 NJIT Conference, Newark, N.J., September 17, 1999.

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## Abstract

This presentation explored a theoretical framework and a practical procedure for assessing the physical environment of urban schools to identify its perceived impacts on the educational process. Models identified in the literature for assessing the quality of the physical environment for learning are reviewed and critiqued. The assessment model presented offers a practical procedure based on a comprehensive theoretical perspective. The Baltimore City Public Schools Environmental Quality Assessment Project, which included five post-occupancy evaluations, were be used as a test case to illustrate the potential use of the assessment procedure in practice. Outcomes of interest from this action research project included student academic performance, student social development and teacher instructional performance. The presentation concluded by emphasizing the value of institutionalizing an on-going process of environmental quality assessment that has implications for integrating facilities management and educational decisions for the benefit of the educational process.

## Presentation

I have been asked to talk about school building assessment within the context of educational outcomes. To my knowledge, the professional activity of building assessment and the research activity of identifying physical factors correlated with educational outcomes, are two separate activities driven by different goals, questions, audiences and expectations.

This observation raises some difficult problems – many of which I'm not going to solve today. The expertise in this room is such that I think I can dispense with the preliminaries on building condition assessment. I'm also not going to talk too much about the links between facilities and learning, since we're probably all true believers anyway except for some of us holdouts who want to pretend we still think critically on this subject.

## An Ecological Model of the Relationship Between Facilities and Educational Outcomes

So, before I move on, I want to share with you a model I developed to help integrate what we know about the linkages between school environments and educational outcomes.

We tend to minimize the complexity of the facilities/outcomes relationship by focusing on single variable relationships. The physical environment consists of many interacting variables that we are all aware of such as class size, spatial density, location & noise, acoustics & noise, secluded study spaces, ambient temperatures and air quality.

The social environment is another complex set of interacting variables including social policies, instructional strategies, peer tutoring to factors related to school climate. Mediating or intervening variables include behavioral factors that can be measured like student-teacher interactions, interruptions, student participation, questioning behaviors, disruptive behaviors. Attitudinal factors that have been measured include teacher morale, teacher and student attitudes towards school. Physiological factors that have been measured include blood pressure and all forms of sensory irritation.

All these intervening factors can theoretically be linked to various educational process outcomes such as student Pro-social Development – which might include measurements of self-concept and Teacher Instructional Performance – or what is commonly referred to as Teacher Quality.

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Finally, the holy grail of the business leads us to Student Academic Performance. Linking anything directly to performance is a difficult task; attempting to link facilities is much more complex. It's the task of embracing this complexity that I want us to consider today. I want talk about primarily today is the challenge of extending the use of our tools of building assessment to building the case for demonstrating the influence of the physical setting on educational processes and outcomes.

I have only two questions I'd like to offer some answers for today. The first is, can we assess the impact of school facilities on learning within the context of practice? And if so -- the second question is -- how do we assess the impact of school facilities on learning within practice? Notice I say, "the context of practice". Within the context of research we have some models -- not without their problems -- but, within the context of practice that may be a more difficult task.

My short answer to these questions, is theoretically, there are ways we can assess the impact of facilities on learning within the context of practice. It can be accomplished through a tradition in the discipline of education called action research -- first introduced by Kurt Lewin, a social psychologist, in 1946 -- and later applied to organizational sciences and finally -- education as a way of closing the gap between research and application.

In short, action research is an approach to research that combines both the traditional goals of social science (that of the generating theories) with the goals of practice to act in affecting change within the social system (in this case schools) in an effort to contribute to the practical concerns of people.

In this sense, research and practice become integrated activities -- not separate activities with different goals and purposes which I would argue is the case in our field at present.

In our field, research has been generated and publicized for the sake of policy, not for design practice. This is not all together bad -- it certainly has helped get the attention of the nation -- it is just a limited model of research utilization.

Take Maureen Edwards excellent study in DC -- the well publicized 5-11% improvement in scores correlated to building condition. Her research has been useful in attempting to sell the need for more dollars for school construction, which is excellent -- and we need more of that kind of research -- however, the research has no immediate usefulness for practitioners attempting to implement positive change in schools.

Even the STAR Project, which has successfully changed policy in decreasing class sizes across the country, does not provide direct implications for the design and management of instructional space. In fact, this policy has in some cases turned school sites into mobile home parks for portable classrooms. Practitioners cannot easily translate research for their immediate use in practice -- this is not news, it's been a problem in many fields.

So, what does this have to do with assessment?

The world of the practitioner and the world of the researcher are interrelated even though each is asking different questions. One wants immediate solutions, the other wants to more carefully define the problem. As the researcher among you, I am going to try today to more carefully define what I see as the problem of linking building assessment to the goal of linking the effects of facilities to educational outcomes.

## Forms of Assessment

There are at least three distinct levels of school facility assessment.

First there is building condition assessment -- in the spirit of Nadine Chin-Santos' piece on the web -- which takes into consideration the physical condition of the school building. Assessment is made against often well-defined codes and regulations centered around safety and health issues. Building assessment is a process of obtaining critical baseline of data for subsequent assessment and decisions. This is the least controversial type of assessment.

Second, is called educational adequacy assessment. Assessing the building's manifest functional characteristics with respect to basic educational activity is the objective here. An assessment of educational adequacy is made against pre-determined criteria -- like adequate space requirements -- generated by experts. This form of

assessment can be a bit more controversial, since what constitutes educational adequacy. Further, how it is weighted can always be questioned. Educational adequacy also makes a first attempt at linking the quality of facilities with general educational program requirements.

A third form of assessment would attempt to link school facility performance to indicators of various educational outcomes. I am reluctantly calling environmental quality assessment (for lack of a better phrase – maybe someone in the audience has a better name to describe it). This form of assessment is the traditional realm of research, not practice. To claim any causal links between a specific facility and learning taking place in that particular facility would seem on the outset highly controversial and suspect. The question is not, what impact do educational facilities have on student learning, but rather, what impact is THIS facility having on THESE students' performance (however defined), and by improving THIS facility, how specifically can THIS GROUP of students' performance be improved?

With the assessment tools we have today we may not be able to answer this question with the precision we might like. However, the idea of linking indicators of facility performance with indicators of human performance is not new. However, a model for this has already developed in the business world and is known broadly as Total Quality Management which uses among other tools of measurement such as benchmarking and various systems of accountability.

While working at a large controls company a few years ago, I was privy to a total quality environments program in which this company proposed to guarantee a certain level of employee performance and/or satisfaction with the ambient environment or the client would get their money back; an advanced form of performance-based contracting to be sure. They of course would only choose indicators they knew they could influence or control positively otherwise they would loose a client.

Assuming for the moment that we could theoretically partition the variance in student performance attributable to the physical building, how could we do this practically?

## Quality

QUALITY...here we go! The 'Q' word of the last half-century with the most definitions. In the interest of time, I will define environmental quality as a perception based on subjective experience. The quality of the physical environment is in the eye of the beholder – be she user, novice or expert. The task of defining the criteria for assessing quality in a particular school becomes a negotiated effort between all stakeholders in the process. Environmental quality is perceived, it will always be perceived, but we can of course create operational definitions and indicators of quality for the purposes of decision making, just as we do for other assessment criteria.

We can think of environmental quality as a "Black Box" which acts a mediator between the dimensions of the school – and educational outcomes. The conventional research approach to investigating environmental quality focuses on the discovery of the "silver bullet" – that discrete physical variable – that will improve test scores.

The most promising variable currently finding its way into policy making is that of class size – with the Tennessee STAR Project being the best example to pick on. Most of you know something about this study so I will only say here that the impressive finding that smaller class sizes showed improvements of achievement as much as 15% on SAT scores. However, these findings do not help us understand what attributes of environmental quality students are experiencing that might account for these improvements in achievement. If we knew what these attributes were we could DESIGN for them.

Another way of asking this question is, what's in the black box that might account for these findings? Decreasing class size seems prudent, but what might be the costs?

Take for example the \$1 billion the State of California spent on reducing class size from 30 to 20 students per class. California schools hired new teachers and placed them in makeshift classes in gymnasiums, libraries, and conference rooms in a race to be awarded state money. The portable classroom business has boomed due to this policy. Its ironic that schools in California are using space the same way poorer urban school districts have been forced to for years, by creating ill-equipped, poorly ventilated classrooms in spaces not originally designed for instruction. I ask you, is this class size policy creating higher quality environments for learning? – it might be, but in most cases probably not.

I propose an alternative approach to the assessment of environmental quality that acknowledges the complexity of the school as a place for learning.

First, there are a plethora of physical aspects of the school in addition to class size that we need to continue looking at in combination. Second, when we open up the black box of quality we find that there are many other attributes of environmental quality that occupants experience in addition to social interaction. Finally, there are other aspects of the educational process outcomes we should be concerned about in addition to academic performance – including student social development and teacher instructional performance.

To complete the model, we need to understand the role facility management of environmental quality and its potential influence on the educational process. I'll talk a bit more about that in my case example.

## **Case Study**

I would like to now provide one complete example of how I have attempted to apply this model to an assessment project. The project involved five elementary schools in Baltimore City Public Schools from 1993-1995. During this time, Education Alternatives, Inc. was contracted with Baltimore City for nine schools. The project was publicized as a public/private partnership – and what critics have called privatization of the public schools for profit. Johnson Controls, Inc. was subcontracted to fulfill facility management services for these nine schools. My charge was to conduct an assessment of a number of these schools and to compare them against comparable schools in the system not being managed by Johnson Controls. Essentially, Johnson Controls wanted to quantify the differences between their services and BCPS facility management services.

I am only interested in sharing with you today the results of applying the model I just described to this assessment project – to give you an idea of potential application. I will talk about other aspects of this larger study at the CEFPI conference next month if you're interested in the full story. The assessment process followed a well-established action research method developed by researchers in the organizational sciences. I'll only going to describe the process briefly here and much of it will probably sound familiar to most of you in the room.

### **1. Group Development**

We worked with EAI, Johnson Controls and BCPS to identify sites to participate in the assessment project. An agreement was then developed with key administrators as to the goals and expectations for the assessment of their schools. We formed action research teams, developed goals for each team and spent some time training team members as necessary concerning the process they would be following.

### **2. Defining a Need for Change**

During the second part of the process we identified problems and needs – what we called environmental concerns – through interviews, student surveys, behavioral observations, and physical condition inventories. From this data collection we developed clearer definitions of how the staff perceived environmental quality. This information was then sorted into categories and reported to the action research group in a series of workshops where participants prioritized environmental concerns and linked them to various educational outcomes.

### **3. Designing a Program for Change**

Only one school moved into the third phase of the assessment process. I will talk about this school – Robert Coleman – at the CEFPI conference with Kate Finston, an assistant principal at the time at that school. Note that the steps during this phase resemble quite closely the standard steps of the strategic planning process we are all familiar with: Identifying Opportunities & Threats, Outlining Organization's Strengths & Weaknesses, Identifying Values, Defining Mission, and Developing a Vision

### **4. Action Plan**

Finally, the action plan is developed – The objective of this final step is to collect and analyze alternative strategic issues to be adopted in the implementation of the intervention process. The key item I would like to point out here is the notion of developing an ongoing process of evaluation – here is where many assessments fall apart. They are often not seen as process within a larger process of implementing change. Maintaining long-term commitment to the process is a challenge that must be confronted with every assessment process.



Here are the statistics on each school in the project (See slide presentation). Suffice it to say, finding comparable school buildings and programs is an almost impossible task. For those who say all schools are alike, they should do a study like this to discover just how varied schools can be!

I now want to jump directly to some of the findings that we arrived at.

Environmental concerns — all the typical kinds of concerns you've heard before — were categorized under specific attributes of environmental quality. Questions were always phrased in terms of qualities like safety and security, ownership and personalization, classroom adaptability, etc — so responses were categorized as qualities automatically and intuitively by participants.

First, I began the assessment study examining 14 attributes of quality identified from the research literature. From these 14 -- four dropped out as not important or critical to the schools -- The remaining ten had various levels of importance. After all the interviews and workshops the attributes of environmental quality that fell out across schools were as follows...

Crowding and Spaciousness at 10,

Sensory Stimulation at 9

Privacy at 8

Places for social interaction at 7,

Personalization and Ownership at 6,

Aesthetics & Appearance at 5,

Building Functionality at 4,

Safety & Security at 3,

Classroom Adaptability at 2,

and the number 1 attribute of EQ was Physical Comfort and Health.

Interesting that Crowding took the tenth spot — illustrates that we don't always know what the most pressing issues are until we start looking and asking.

When we asked the action teams to identify which environmental concerns they perceived to be influencing particular educational outcomes, here is what we found...

Notice Physical Comfort and Health is perceived to influence all three educational outcomes. Classroom Adaptability and Safety and Security are not far behind. Notice, again, Crowding is not perceived to have an influence one way or another on educational outcomes — In some sites it might, but not on these sites.

As conventional researchers we could now take these relationships as hypotheses. As practitioners, we now know which attributes of quality need to be improved AT THESE SITES and can focus efforts in the action plan to address these attributes.

Finally, a look at the big picture — a full model that brings us back to the black box model — and provides some perspective on just how complex — but identifiable — perceived links between the physical environment and educational outcomes can be.

These are an aggregated listing of the environmental concerns perceived by participants in all 5 schools (see Slide Presentation).

Next — the black box opens up and we can see specific relationships between environmental concerns and perceptions of environmental quality. By association — we can model participant perceptions of what environmental qualities were having an impact on particular educational outcomes — here I simply illustrate the perceived links to student academic performance...

Finally — the perceived links between facility management and educational outcomes -- suggests a plan of action for a strategic on-going facility management program linked explicitly to educational goals.

But – the story is not over yet! Once I was able to document all the environmental concerns in these schools -- I was curious to know if there was a correlation between...

### **Environmental Quality and Educational Outcomes**

I did find a relationship between the number of environmental concerns and student academic improvement. This graph (see slide presentation) illustrates an negative relationship between the number of high-priority environmental concerns expressed in any one school.

With the percent student academic improvement between 1993-1995 – as reported in the Maryland School Performance Program Report). This data point represents one school experiencing a relatively large number of concerns while reporting a drop in test scores. On the other end of the line, we have another school experiencing a relatively low number of concerns while reporting an increase in test scores.

Many in the social science community would criticize the validity of this finding based on the fact that, the study is exploratory, the sample of schools was not randomized – and therefore – the findings cannot be generalized beyond the sample itself and the correlation does not suggest a causal relationship. I will admit these limitations of this study. However, I believe I've found an emerging pattern between environmental quality and educational outcomes that should be investigated further.

Additional research will allow us to generalize beyond from the context of local school settings – once we can gather significantly more data points. (I wonder if anyone in the audience today would be able to help me obtain more data points!)

With this said, what can this graph really tell us about the nature of environmental quality?

Similar to the class size research example I mentioned earlier – we would be falling into a similar trap as California policymakers are looking for a one-size-fits-all solution to a very complex problem. We need to go deeper into the data – to learn more about how quality is perceived and relates to outcomes – SITE BY SITE. As researchers we want to know why – so as practitioners we can know more about how to improve settings for learning.

In order to improve outcomes, we will need to find ways to improve environmental qualities in schools that will make a difference in those particular schools. We need to know what particular qualities each school feels contributes most to student performance. The only way to do this is to work directly and seriously with staff from these schools to obtain an accurate reading of their perceptions. Teachers and administrators are not always the most environmentally competent. They are not always completely aware of the relationship between their physical setting and the educational process they are engaged in. School cultures need to develop processes of continuous learning and improvement so that environmental competence improves site by site.

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For more information on the activities of the UEF21, a Chapter of Council of Educational Facility Planners International see <http://www.designshare.com/UEF.htm>

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# Assessing the Impact of the Physical Environment on the Educational Process: Integrating Theoretical Issues with Practical Concerns

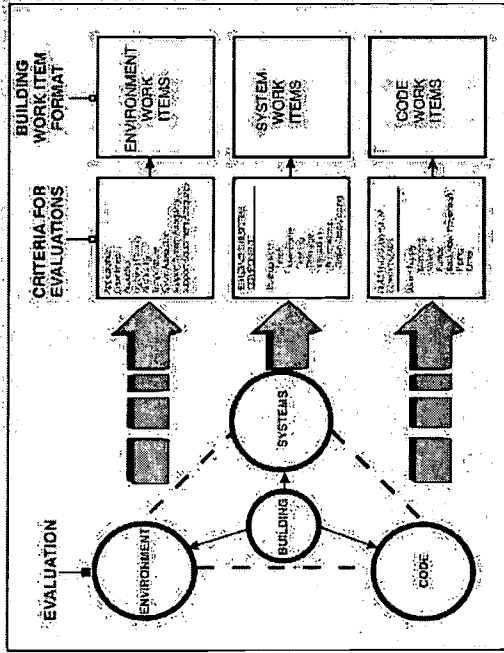
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*Urban Educational Facilities for the 21st Century (UEF21)*  
CEFPI Northeast Chapter First Annual Conference  
November 17, 1999



# Overview



BCAT contains an optional inventory module, which catalogues all the infrastructure elements of the building for quick reference and future planning. The module includes the following:

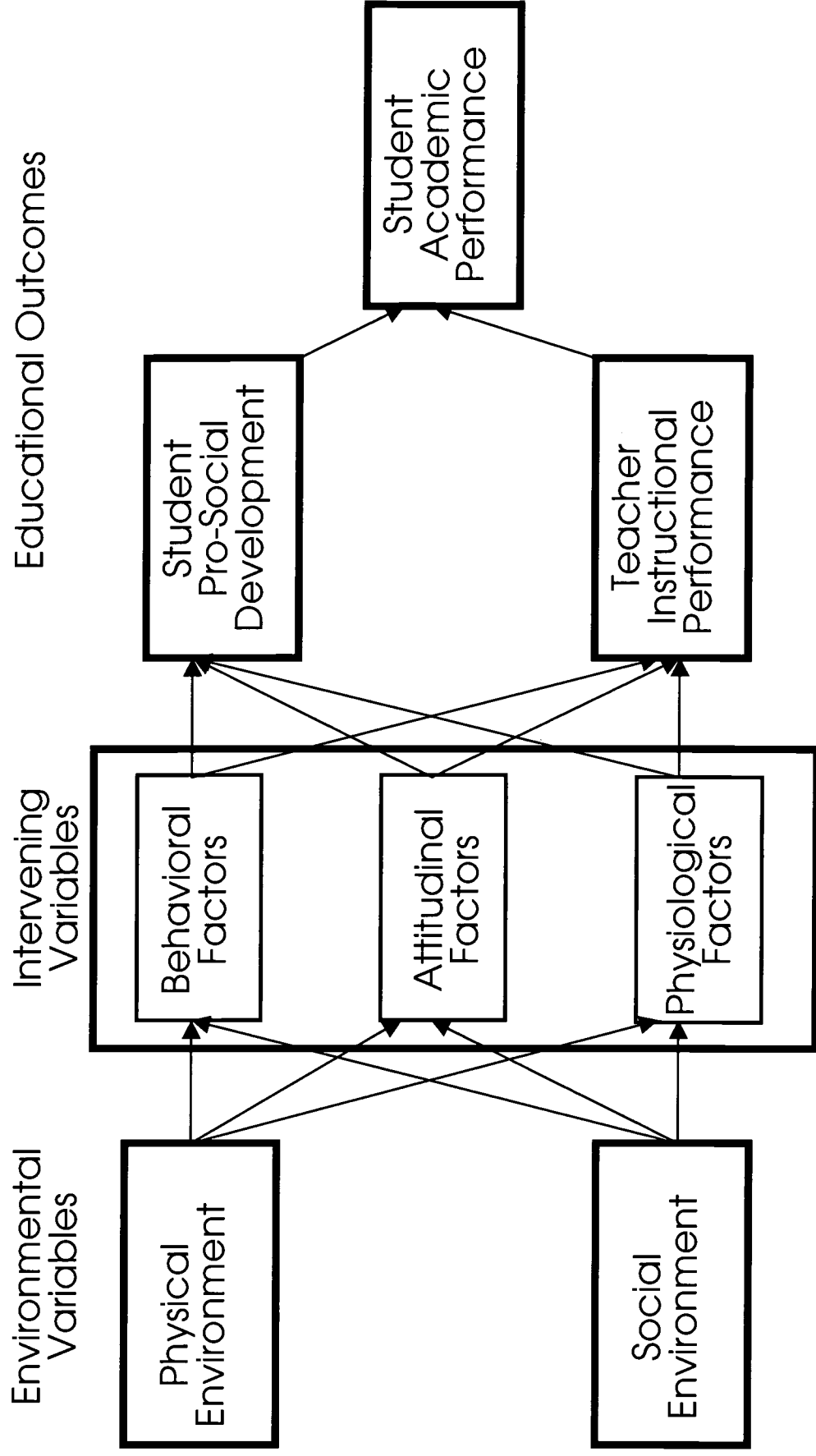
- Basic Building Identification
- Design Years
- Building Utilities and Services
- Site Information
- Building Systems
- Life Safety and Fire Protection Systems
- Elevator Information
- Building Code Information
- Security Systems
- Logs & Schedules
- Service Contracts
- Hazardous Waste Information

# Educational Outcomes Assessment

	Coleman #182	Tubman #188	Monroe #32	Coldstream #31	Browne #25
Environmental Concerns Expressed (high priority)	16	8	8	7	5
Student Knowledge % Improvement (from 0-25 Average)	-10.67	+0.8	+11.33	+15.30	+22.67

# Overview

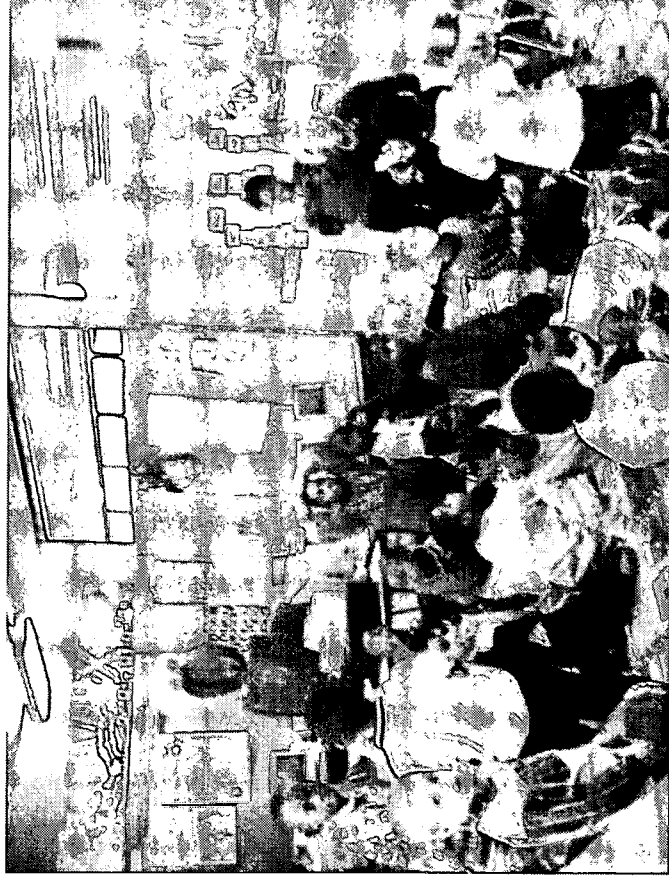
## Links Between Environment & Educational Outcomes



# Overview

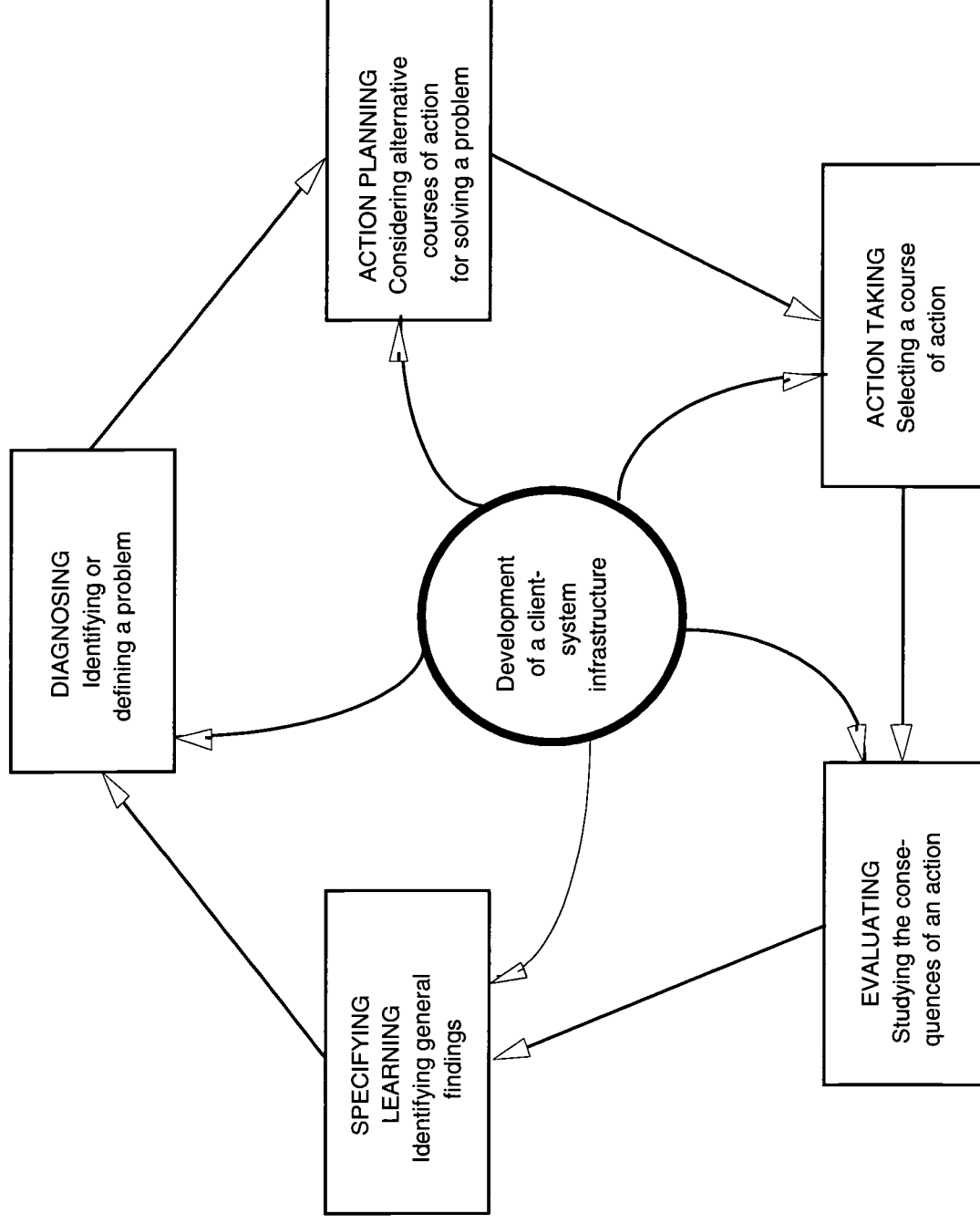
1. Can we assess the impact of school facilities on learning within the context of practice?

2. If so, How?

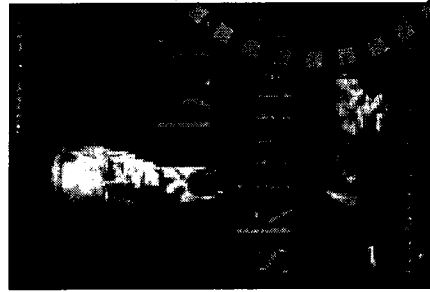


# Overview

## Action Research Process



# Overview

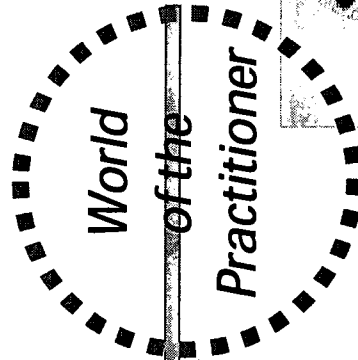


Quantitative  
Inquiry



Laboratory  
Setting

Rigor



Field  
Setting



Qualitative  
Inquiry

**Different goals  
between research  
and practice**

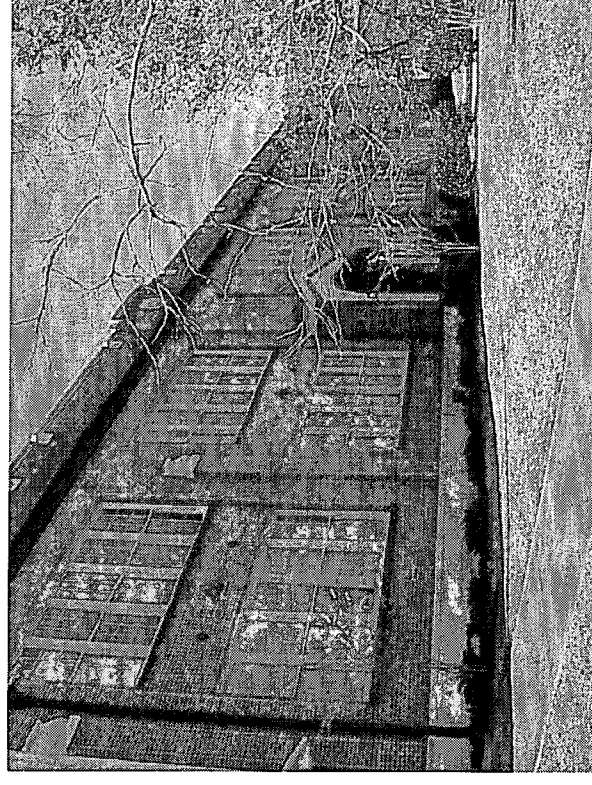


# Environmental Assessment

## Forms of Assessment

### 1. Building Condition Assessment

- baseline conditions
- codes & regulations
- least controversial



# Environmental Assessment

## Forms of Assessment

### 1. Building Condition Assessment

### 2. Educational Adequacy Assessment

- functional analysis
- educational activities
- assessment criteria



# Environmental Assessment

## Forms of Assessment

1. Building Condition Assessment
2. Educational Adequacy Assessment
3. Environmental Quality Assessment
  - Linking building performance to educational outcomes
  - Claims to improve student performance
  - Highly controversial

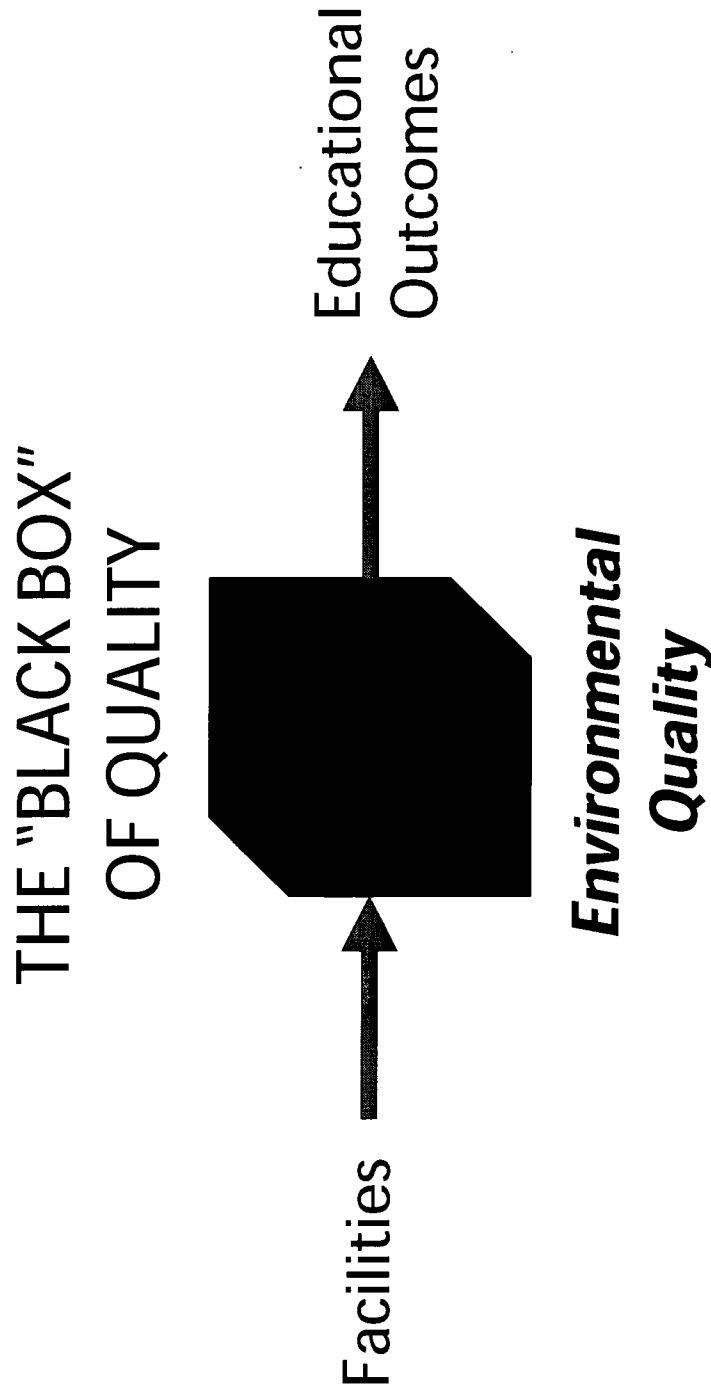


# Environmental Assessment

## Environmental Quality

- quality is a perception based on subjective experience
- assessment criteria needs to be negotiated between all stakeholders
- operationalization will then be meaningful

# Models of Environmental Quality Assessment





# Models of Environmental Quality Assessment

**Educational  
Environment**

Organizational  
Setting

Facility

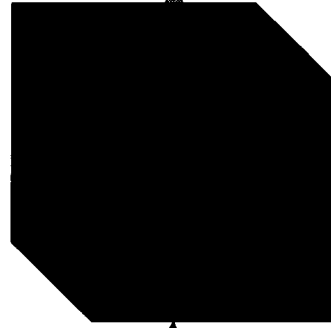
Management

Physical

Environment

Social

Environment

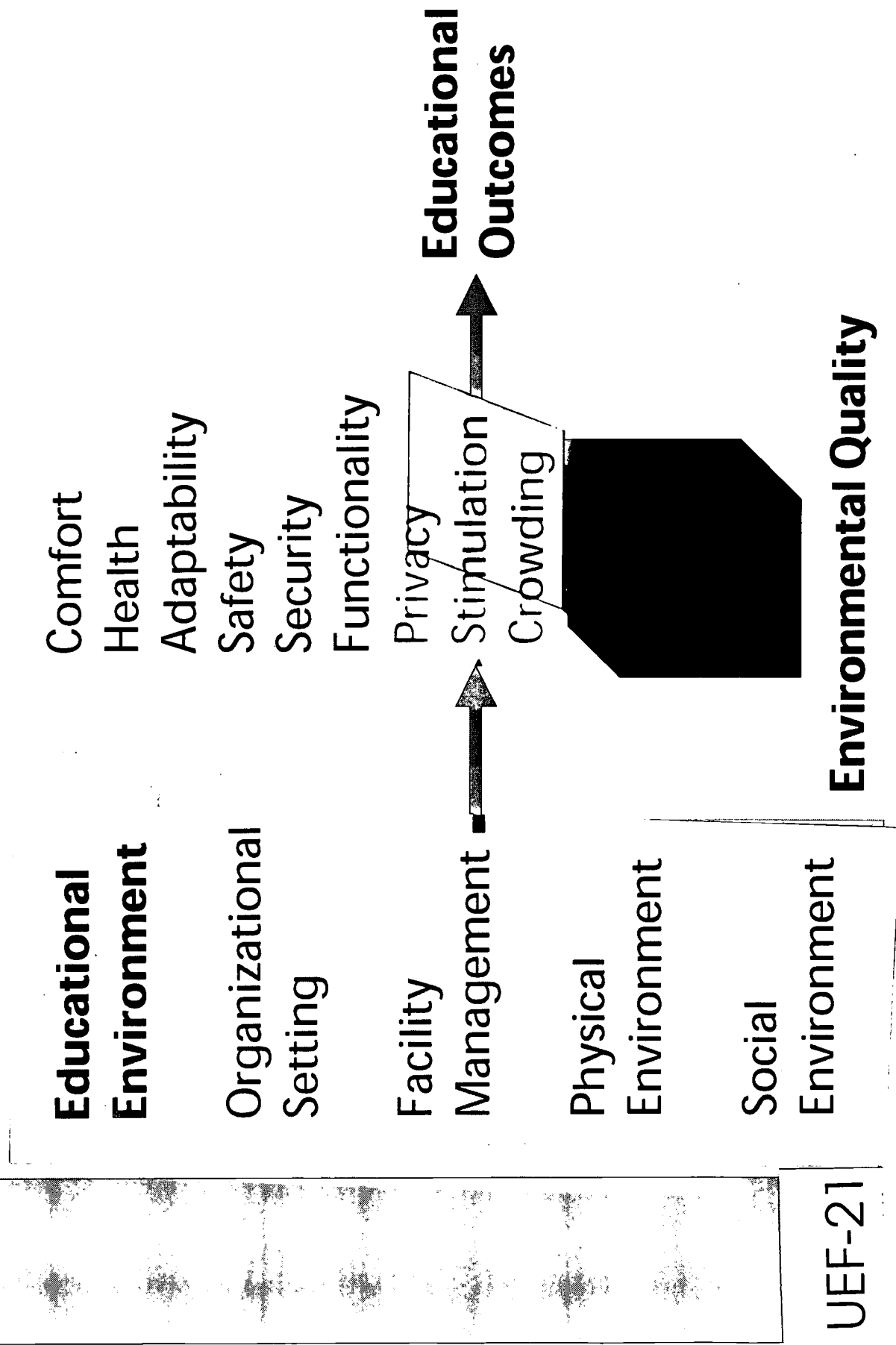


**Environmental  
Quality**

**Educational  
Outcomes**

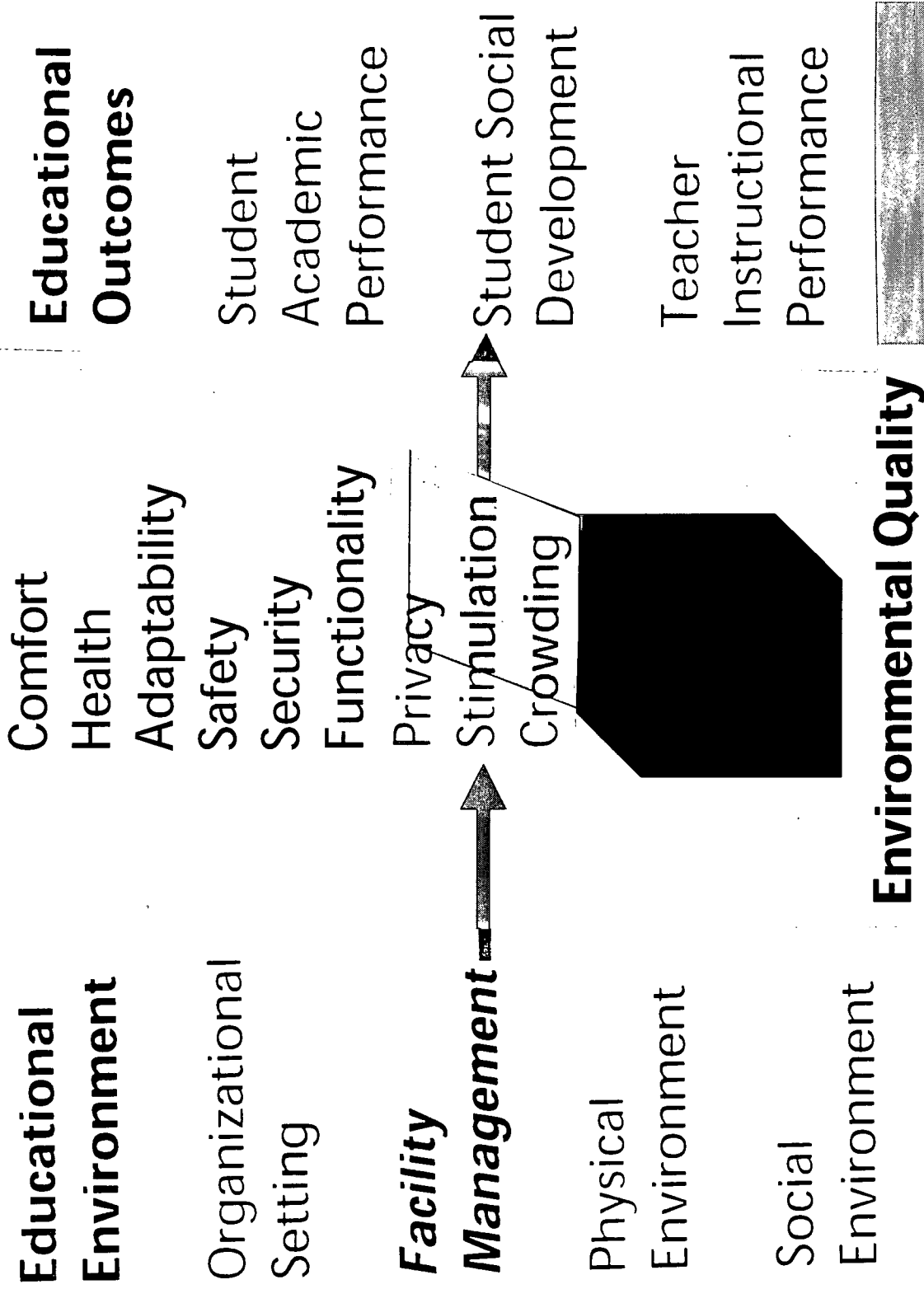
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# Models of Environmental Quality Assessment



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# Models of Environmental Quality Assessment



# CASE STUDY

## Baltimore City Public Schools

### Environmental Quality Assessment Project



# A Case Study in Environmental Quality Assessment

## The Assessment Process

### 1. Group Development

- Process of Entry
- Drawing up an Agreement
- Forming Action Research Team
- Developing Goals for Team
- Training Team





# A Case Study in Environmental Quality Assessment

## The Assessment Process

### 1. Group Development

### 2. Defining a Need for Change

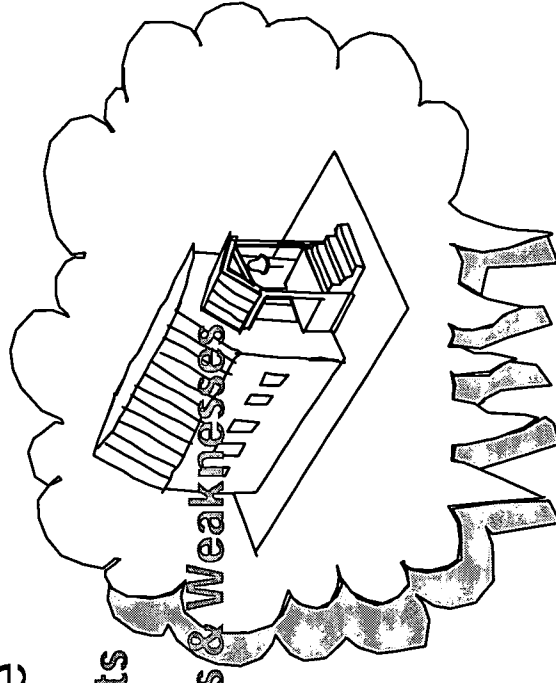
- Identifying Problems & Needs
- Using Interviews to Develop Measures
- Sorting Information in Categories
- Collecting and Reporting Data

<u>Environmental Concerns</u>	
<b>HIGH PRIORITIES</b>	
1. Playground unsafe	
2. Overcrowded classrooms	
3. Too Cold!	
4. Air Quality	
5. Inadequate lobby design	
6. Underutilized library	
7. Lack of adequate bathroom ventilation	
8. Computer problems	
9. Problems with parents finding way	
10. Storage unorganized	
11. Safety in parking lot	
12. Ventilation for science projects	
13. Open space vs Self-contained	
14. Safety from intruders	
15. Visibility & Surveillance	
16. Vision of one stop shop interagency	
17. First floor instructional area layout	
18. Crowded administration area	
<b>MODERATE PRIORITIES</b>	
19. Landscaping projects	
20. Sharing lockers	
21. No views out windows	
22. Signs of academic unity	
23. Student work displays	
24. ADA accessibility	
25. Plumbing & flooding	
<b>LOW PRIORITIES</b>	
26. Non-use of teachers lounge	
27. School-wide assemblies	

# A Case Study in Environmental Quality Assessment

## The Assessment Process

1. Group Development
2. Defining a Need for Change
3. Designing a Program for Change
  - Identifying Opportunities & Threats
  - Outlining Organization's Strengths & Weaknesses
  - Identifying Values
  - Defining Mission
  - Developing a Vision



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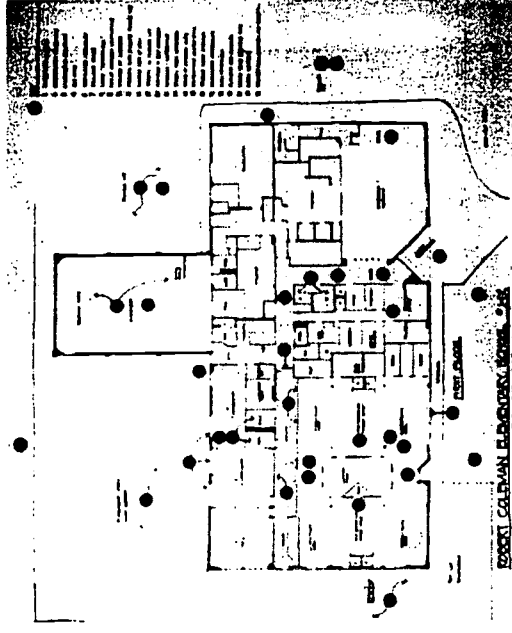
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# A Case Study in Environmental Quality Assessment

## The Assessment Process

1. Group Development
2. Defining a Need for Change
3. Designing a Program for Change
4. Action Plan

- Developing the Strategic Issue or Alternative
- Identifying Strategic Direction for the Issue
- Developing an Action Plan
- Developing an Ongoing Process of Evaluating
- Developing a Commitment Plan



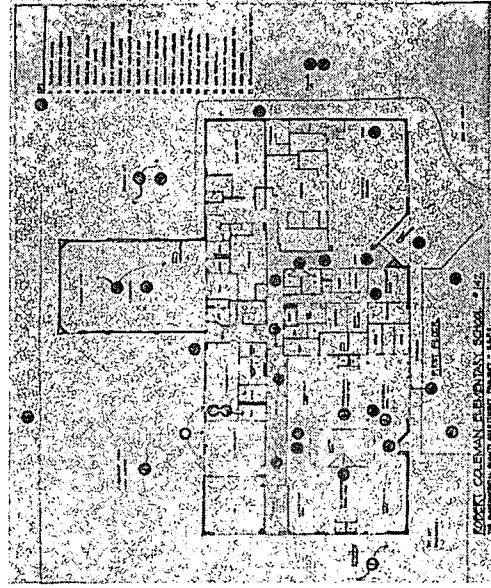
# A Case Study in Environmental Quality Assessment

## Case Studies

	Coleman #142	Tubman #138	Monroe #32	Coldstream #31	Browne #25
Occupied	1980	1979	1971	1979	1976
GSF	46,000 GSF	46,000 GSF	64,000 GSF	80,000 GSF	41,000 GSF
Layout	Open Space/ Self-Contained	Open Space/ Self-Contained	Self-Contained	Self-Contained Pods	Open Space
Capacity	450	500	530	850	400
Population	582	420	232	577	348

# A Case Study in Environmental Quality Assessment

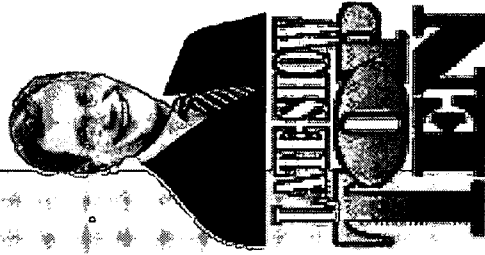
## Environmental Concerns & Qualities



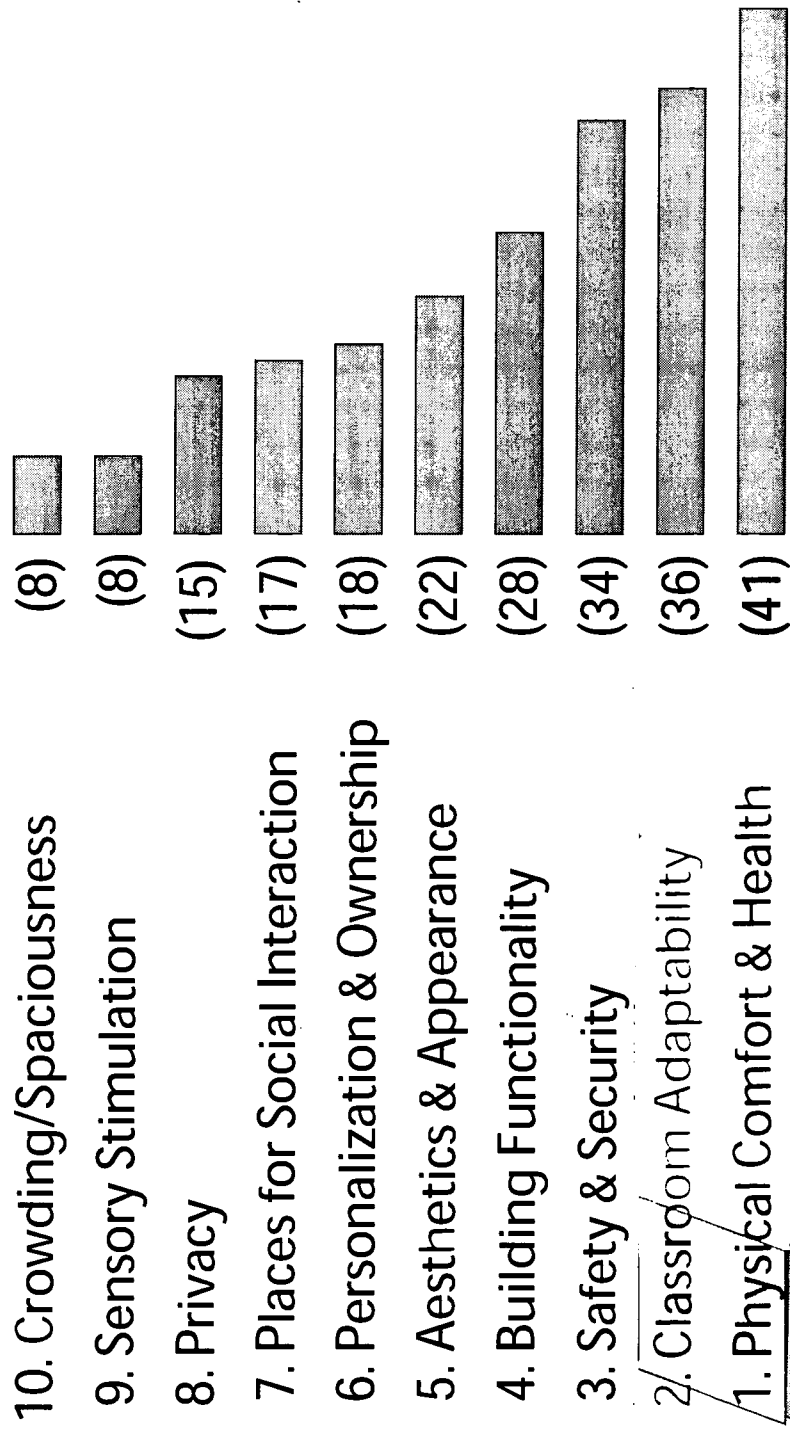
<i>Environmental Concerns</i>	<i>Principle Attribute of Environmental Quality</i>
<b>HIGH PRIORITIES</b>	
1. Playground unsafe	Safety & Security
2. Overcrowded classrooms	Crowding & Spaciousness
3. Too Cold!	Physical Comfort & Health
4. Air Quality	Physical Comfort & Health
5. Inadequate lobby design	Building Functionality
6. Underutilized library	Building Functionality
7. Lack of adequate bathroom ventilation	Physical Comfort & Health
8. Computer problems	Classroom Adaptability
9. Problems with parents finding way	Wayfinding & Orientation
10. Storage unorganized	Classroom Adaptability
11. Safety in parking lot	Safety & Security
12. Ventilation for science projects	Physical Comfort & Health
13. Open space vs Self-contained	Building Functionality
14. Safety from intruders	Safety & Security
15. Visibility & Surveillance	Safety & Security
16. Vision of one stop shop interagency	
17. First floor instructional area layout	Classroom Adaptability
18. Crowded administration area	Building Functionality
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25. Plumbing & flooding	Physical Comfort & Health
<b>LOW PRIORITIES</b>	
26. Non-use of teachers lounge	Building Functionality
27. School-wide assemblies	Building Functionality



# A Case Study in Environmental Quality Assessment



## "TOP TEN" Environmental Quality Concerns

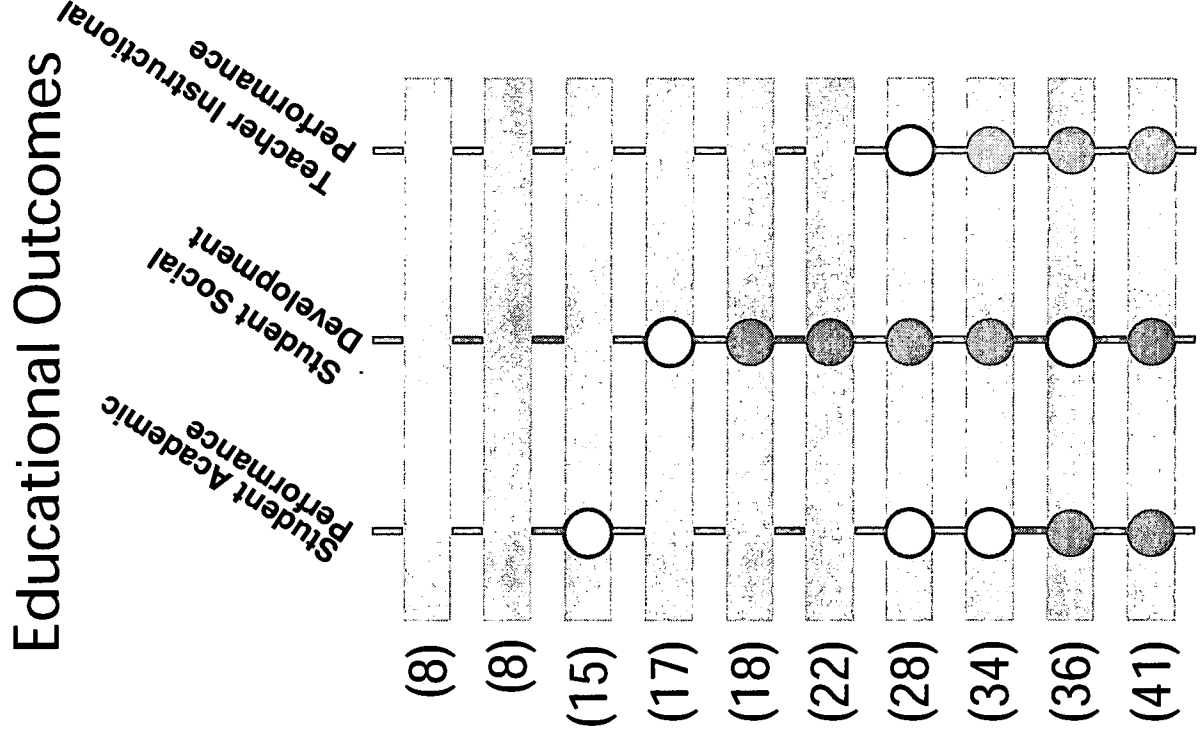


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## Links Between Environmental Quality & Educational Outcomes

● Strong link    ○ Moderate link

10. Crowding/Spaciousness
9. Sensory Stimulation
8. Privacy
7. Places for Social Interaction
6. Personalization & Ownership
5. Aesthetics & Appearance
4. Building Functionality
3. Safety & Security
2. Classroom Adaptability
1. Physical Comfort & Health

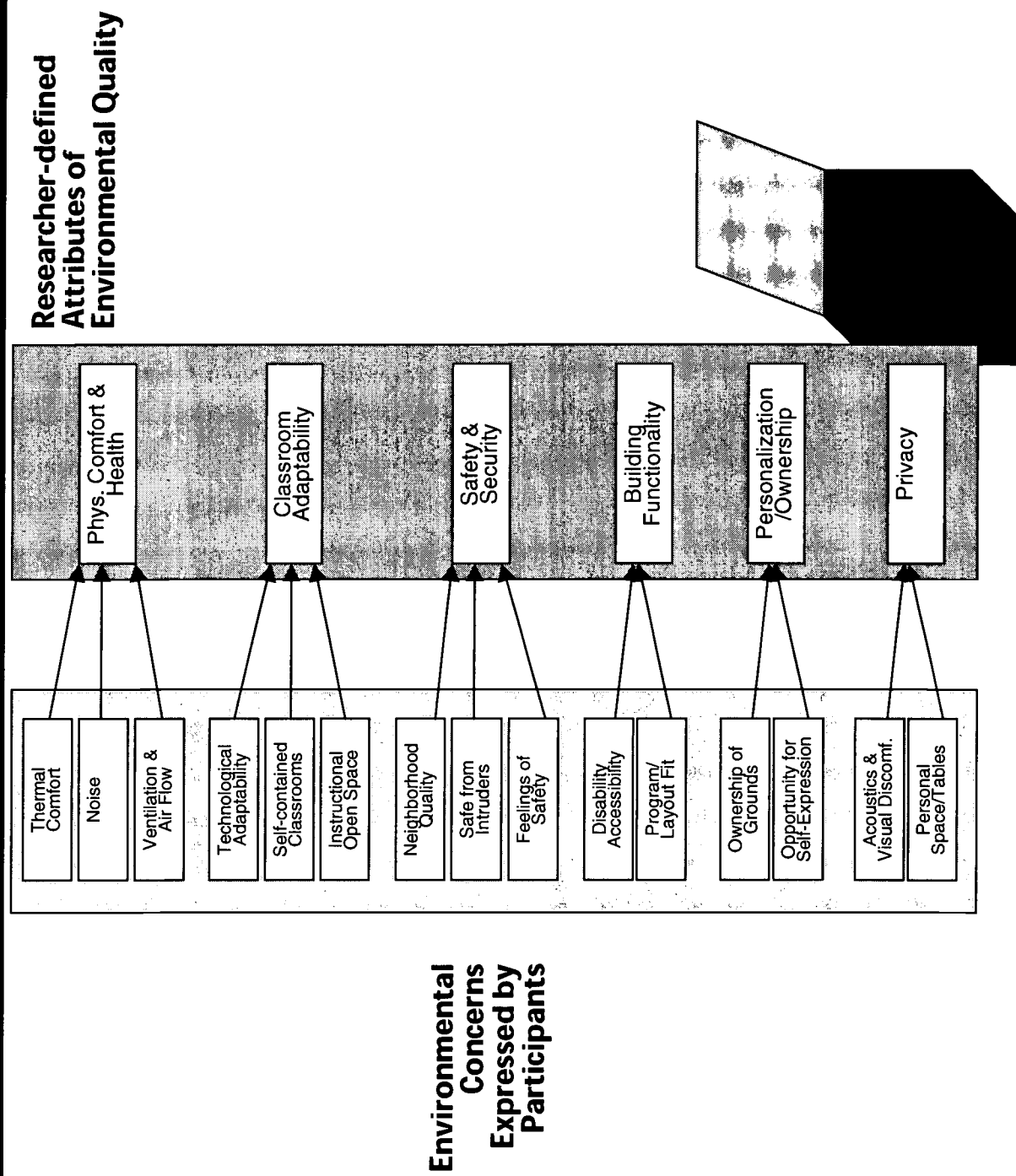


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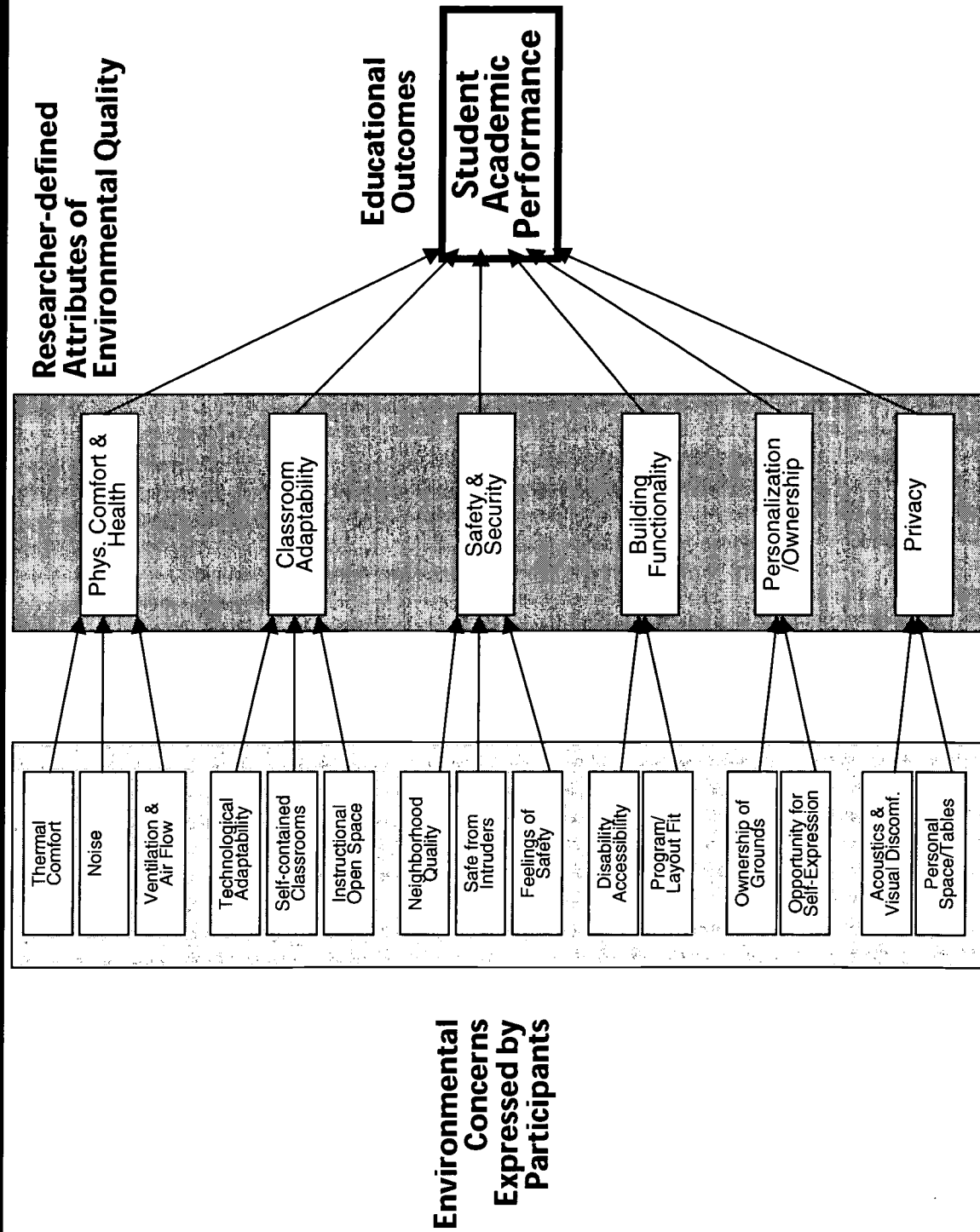
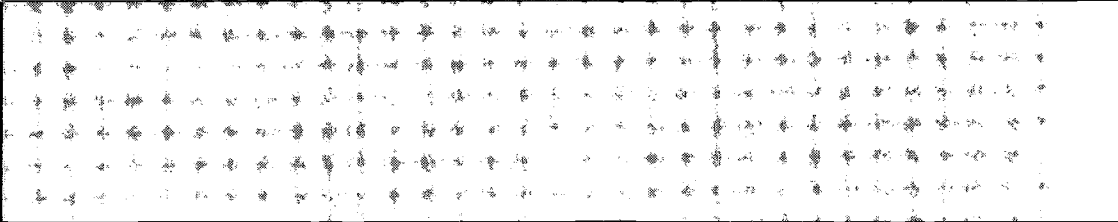
## Environmental Concerns Expressed by Participants

Thermal Comfort
Noise
Ventilation & Air Flow
Technological Adaptability
Self-contained Classrooms
Instructional Open Space
Neighborhood Quality
Safe from Intruders
Feelings of Safety
Disability Accessibility
Program/ Layout Fit
Ownership of Grounds
Opportunity for Self-Expression
Acoustics & Visual Discomf.
Personal Space/Tables

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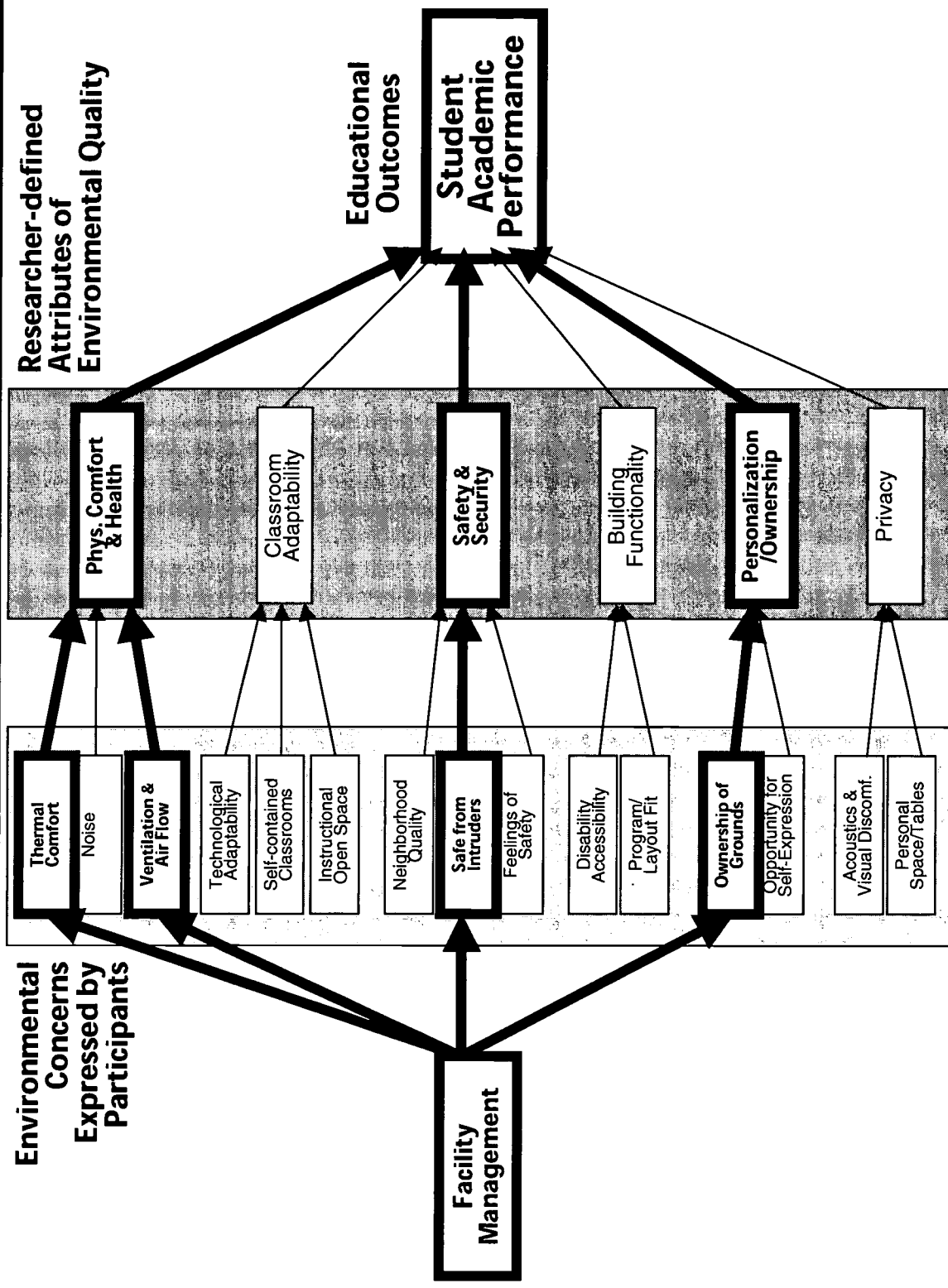


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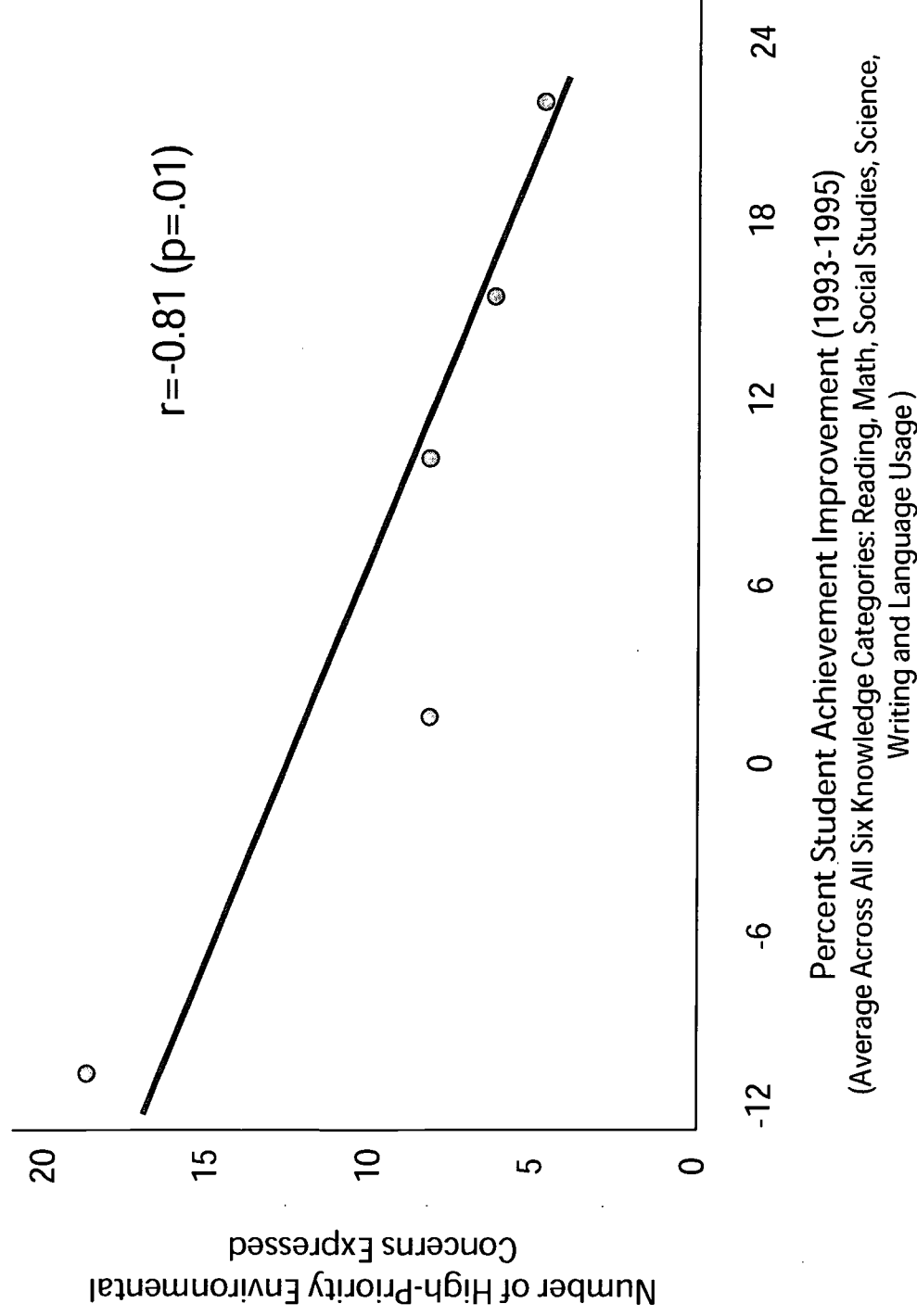
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# A Case Study in Environmental Quality Assessment

## Relationship Between No. of High-Priority Environmental Concerns & % Student Academic Improvement



## Conclusions

- Know environmental qualities at each site that contributes most to students' performance
- Work directly and seriously with staff to obtain perceptions - engender meaningful collaboration
- Teachers & administrators are not always the most environmentally competent - training required
- As professionals we can not do it all - need an interdisciplinary team
- Develop a process of continuous improvement within each school site



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